

# The Localization of Emerging Green High-Tech Industries

**Tanner, Anne Nygaard**

*Publication date:*
2011

# The Localization of Emerging Green High Tech Industries

**Anne Nygaard Tanner**
**Technical University of Denmark**
**Department of Management Engineering**

## WHERE DO GREEN HIGH-TECH INDUSTRIES OF THE 21ST CENTURY LOCATE? AND WHY?

**Most regions in the world dream of hosting the next Silicon Valley. This is because high-tech industries are associated with innovation and entrepreneurial activity that may provide a platform for future economic growth. However, today we have little systematic knowledge on where radical new industries locate and why.**

**This poster shows that the emerging fuel cell industry is technologically related to the knowledge bases of the regions it develops in.**

Evolutionary economic geographers propose that new industries are place dependent and tend to develop where regional knowledge bases are technologically related to the knowledge base of the new industry. This process has been labeled 'regional branching' which depicts that new industries grow out of the existing industry of a region.

This study contributes to this literature in three ways:

1. Examines if radical industries also are 'place dependent'
2. Develops a new measure of 'technological relatedness'
3. Analyses the 'degree of technological relatedness'

## THE CASE – GREEN ENERGY TECHNOLOGY:

**Hydrogen and fuel cell technology has the potential to replace incumbent fossil fuel based energy technologies**

***New Solar Hydrogen Station,*** *Los Angeles-based Station to Re-fuel Honda Fuel Cell Electric Vehicle and the* ***Honda FCX Clarity***

A fuel cell is an electro chemical device that produces electricity from a continuous flow of fuel, usually hydrogen. If hydrogen is produced from renewable energy sources, such as wind or solar energy hydrogen fuel cells are completely CO2-neutral. Fuel cells are potentially applicable in a wide range of products within transport, portable equipment, and stationary power.

## POLICY IMPLICATIONS:

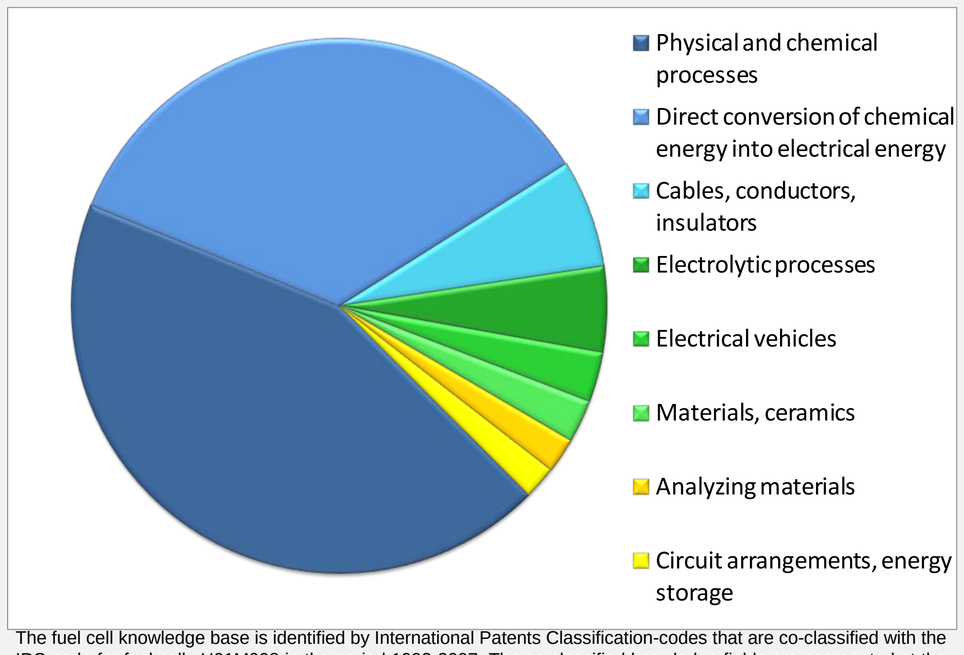
This study provides evidence for the European policy recommendations that has been labelled 'Smart Specialization'. This study confirms that it is more promising to encourage investments in regional complementary competences, instead of aiming at frontier technology development that is technologically unrelated to a region's knowledge base.

Regional authorities that want to host the 'Silicon Valley of Fuel Cells' should base its strategy on regional strengths and either invest in advancing the core technology, or invest in the application of the new technology within preexisting related sectors.

## ANALYSIS:

First, we identify knowledge that is technologically related to fuel cell technology. The fuel cell knowledge base has been identified by analyzing the International Patent Classification co-classifications of all fuel cell patents. The co-classified knowledge fields has been interpreted as constituting the fuel cell knowledge base and consequently perceived to be a good measure for fuel cell related knowledge.

### Fuel Cell knowledge base




The fuel cell knowledge base is identified by International Patents Classification-codes that are co-classified with the IPC-code for fuel cells H01M008 in the period 1993-2007. The co-classified knowledge fields are aggregated at the level of IPC-subclasses (4 digits) (see Tanner 2011).

The analysis is carried out on a balanced panel data set comprising the years 1993-2007. For each region we identify

1) *Dependent variable:* the production of fuel cell knowledge
2) *Independent variable:* the generation of fuel cell technologically related knowledge for all non-fuel cell knowledge production

## RESULTS:

The study concludes that the higher the degree of technological relatedness is, the higher is the probability of a region to diversify into a radical new industry.

Table 1 and 2 below presents the results:

- Table 1 shows that 5 out of 8 knowledge fields are positively related to fuel cell knowledge production – highlighted in red in column (2)
- Table 2 shows that the more of the eight fuel cell related knowledge fields that are present in a region, the stronger is the probability of a region to diversify into fuel cell knowledge production.

This confirms the evolutionary thesis of 'industries being place dependent', and that regional economic development – also when it comes to radical industries – are highly path dependent.

| | (1) | (2) | | (3) |
|---|---|---|---|---|
| **Fuel cell related knowledge fields:** | | | | |
| **Physical and chemical processes** | | **0.486 (0.103)*** ** | **The degree of fuel cell relatedness:** | |
| **Direct conversion of chemical energy into electrical energy** | | **1.492 (0.644)**** | **1 out of 8** | 0.299 (0.348) |
| | | | **2 out of 8** | 0.258 (0.344) |
| | | | **3 out of 8** | **0.6560 (0.342)*** |
| **Cables; conductors; insulators;** | | **5.532 (1.256)*** ** | **4 out of 8** | **0.818 (0.344)**** |
| **Electrolytic processes** | | -1.441 (2.399) | **5 out of 8** | **1.128 (0.347)*** ** |
| **Electrical vehicles** | | -2.079 (2.801) | **6 out of 8** | **1.192 (0.349)*** ** |
| **Ceramics; material** | | **1.301 (0.544)**** | **7 out of 8** | **1.398 (0.352)*** ** |
| **Analyzing materials** | | **2.547 (0.195)*** ** | **8 out of 8** | **1.667 (0.359)*** ** |
| **Circuit arrangement; storing** | | 2.466 (1.812) | | |
| Constant | 11.627 (1.759)*** | 3.677 (2.081)* | Constant | 13.842 (1.932)*** |
| Lag.1 fuel cell patents | | 0.010 (0.001)*** | Lag.1 fuel cell patents | -0.001 (0.001)** |
| R&D (LOG) | 1.101 (0.076)*** | 0.620 (0.085)*** | R&D (LOG) | 0.891 (0.095)*** |
| Population (LOG) | -1.267 (0.139)*** | -0.557 (0.163)*** | Population (LOG) | -1.386 (0.156)*** |
| N (regions) | 172 | 172 | N (regions) | 172 |

TABLE 1 (on the left) and TABLE 2 (on the right): Regional fuel cell related knowledge stock effects on fuel cell patenting, negative binomial regression with fixed effects for 172 European NUTS 2 regions, 1993-2007. Dependent Var.: The sum of fuel cell patents for three consecutive years for each region for each year. Source: OECD REGPAT, December 2010
TABLE 1: Independent Var.: cumulated fuel cell related knolwedge stock normalized by regions' total patent count and discounted by 20% annually to reflect depreciation of knowledge.
TABLE 2: Independent Var.: a categorial variable taking the values 0-8. 0 if none of the fuel cell related knowledge fields are present in the region, and 8 if all of them are present in a given region a given year.
Controls: Lagged dependent variable, GERD (R&D), and population
*** P<0.001, ** P<0.05, * P<0.1

## RELATED RESEARCH:

For more details on this study and on related research scan the QR Barcode to the right and visit my homepage.